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Concurrent Verbal Protocol Analysis in Sport: Illustration of Thought Processes During a Golf-Putting Task

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The purpose of this study was to examine the feasibility of concurrent verbal protocols to identify and map thought processes of players during a golf-putting task. Three novice golfers and three experienced golfers performed twenty 12-foot putts while thinking aloud. Verbalizations were transcribed verbatim and coded using an inductive method. Content analysis and event-sequence analysis were performed. Mapping of thought sequences indicated that experienced players' cognitive processes centered on gathering information and planning, while beginners focused on technical aspects. Experienced players diagnosed current performance aspects more often than beginners did and were more likely to use this information to plan the next putt. These results are consistent with experienced players' higher domain-specific knowledge and less reliance on step-by-step monitoring of motor performance than beginners. The methods used for recording, analyzing, and interpreting on-line thoughts of performers shed light on cognitive processes, which have implications for research.

Keywords: golf, verbal reports, cognitive processes, verbalizations.

A golf putt is considered a closed skill, as it has clearly defined beginning and end points. As a "self-paced" task, its execution is entirely controlled by the athletes and occurs under stable and predictable environmental conditions (Singer, 1988). Putting is a crucial aspect of the game of golf. If one assumes that the score of par requires golfers to play two putts per hole, this stroke represents 36 putts in a par round of 72. Improving the quality of putting may result in a significant decrease in golfers' overall scores. Therefore, understanding the cognitive processes that take place during the execution of this skill may have important implications for athletes' development. Knowledge of cognitive processes during this task can inform coaches and athletes and potentially expedite athletes' development process.

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To capture these essential cognitive processes during competitive events, ecologically valid methods have been suggested. Ericsson and Simon's (1993) verbal protocol method allows for the study of these processes while they are occurring (e.g., Nicholls & Polman, 2008). Cognitive processes can be detected through "thought expression" elicited through verbal protocols during task performance. Verbal protocols have been used to study participants' cognitive processing strategies during problem solving, decision making, and judgment tasks in a variety of domains such as chess (e.g., Charness, 1981; Chase & Simon, 1973), sport (e.g., McPherson, 1999a, 1999b, 2000), music (e.g., Waters, Townsend, & Underwood, 1998), and aviation (e.g., Wiggins & O'Hare, 1995). The method consists of recording verbalizations of participants' thoughts when they are performing a task or after task completion. Collecting c*oncurrent verbal protocols* requires participants to "talk aloud" or "think aloud" as they perform a task. Ericsson and Simon argued that these procedures do not change participants' cognitive processes because they are reported as information being processed. As "task-directed cognitive processes determine what information is heeded and verbalized" (p. 16), talk-aloud procedures minimize potential hazards of introspection and inferences about behavior.

Ericsson and Simon (1993) stated that difficulties with "verbalizing perceptual-motor processes are more visible in problem situations where the problem is represented physically, and performance involves manipulation of this physical representation" (p. 92). Verbalization of highly automatic tasks is improbable because the required information to perform such tasks is not available in short-term memory (Beilock, Wierenga, & Carr, 2002). Beilock and colleagues (Beilock & Carr, 2001; Beilock et al., 2002) demonstrated an impoverished episodic recollection of putts among expert golfers (e.g., "describe the last putt you took, in enough detail"), which suggests that skilled putting is encoded in a procedural form that supports performance without the need for step-by-step attentional control. In highly automatic tasks, verbalizing heeded information is not likely to increase task complexity or to interfere with automatic processes; subjects verbalize what is being heeded in working memory and accessed at a conscious level. Beilock et al. (2003) suggested utilizing a concurrent verbal protocol to ascertain to what type of information athletes are attending while putting and whether this information is consistent with findings of poor episodic recollections of experts compared with novices.

It has been described that skilled golfers reported greater pregame and preshot planning, rehearsal, and visualization than did less accomplished golfers (McCaffrey & Orlick, 1989). Skilled golfers have also demonstrated higher levels of concentration and automaticity and appear to dwell less on past mistakes and missed opportunities (e.g., Thomas & Over, 1994). Thus, if the information reported is consistent with information heeded in working memory, it is expected that, compared with beginners, experienced players should report fewer details associated with the technical components of the skill and more details of the decision-making process associated with the planning of the shot.

To study thought and attention processes, Beilock and colleagues' (Beilock & Carr, 2001; Beilock et al., 2002) used controlled environmental conditions in which analysis of environmental settings relevant to performance were not present (e.g., terrain slope, grass height). Therefore, heeded information by participants is likely to portray a limited representation of the entire spectrum of situational cues golfers have to attend to when performing on a green.

Verbal protocols in sport have been scarcely used, but in the last two decades there has been increased interest in this method for the study of a variety of issues, such as learning processes in bowling (Langley, 1995) and volleyball (Ram & McCullagh, 2003); congruence between actual and retrospective reports of emotion (Tenenbaum & Efran, 2003; Tenenbaum, Lloyd, Pretty, & Hanin, 2002); tactical decisions in tennis (McPherson, 1994, 1999a, 1999b, 2000; McPherson & Thomas, 1989), volleyball (McPherson & Vickers, 2004), and baseball (McPherson & MacMahon, 2008); and stress and coping in golf (Nicholls & Polman, 2008). Verbal protocols in McPherson and colleagues' studies were used to infer players' problem representations, solution processes, and domain-specialized strategies and to show how experts accessed complex tactical problem representations, which guided their encoding for critical environmental cues and retrieval of relevant and detailed knowledge structures from long-term memory. Experts' superior decision making was linked to specific memory structure adaptations, which were termed "current event profiles" and "action plan profiles" (McPherson, 2000). Experts used more sophisticated action plans and current event profiles, while novices rarely planned and seemed to lack these memory structures. The more frequent use of current event profiles may allow experts to easily access and retrieve relevant information to make decisions and adjustments during competition. Pertaining to the golf-putting task, it is expected that skilled golfers are able to plan the shot more systematically and use the information of the outcome to adjust the strategy in approaching the subsequent shot.

The present study has two main purposes: (a) to use a concurrent verbal protocol approach aimed at identifying patterns of thought processes and (b) to compare the content and sequence of thought processes of players of varying skill levels by utilizing an event-sequence analysis.

Method

Participants

The sample was comprised of three experienced golfers and three beginners (N = 6), ranging in age from 23 to 27. All participants were Caucasian university students who had a variety of experiences with golf. Experienced golfers were males who had been playing golf for 11–15 years. Participant E1 estimated having played 75 hr of golf in the previous year, currently played twice per month, and held a handicap of 13. Participant E2 had been a collegiate golfer. He reported having played approximately 800 hr last year; currently, he plays once per month, and his handicap is zero. Participant E3 reported having played 60 hr last year. He currently plays once per week with a handicap of 18.

Beginners were three females (participants B1, B2, and B3). Participants B1 and B2 had been playing golf for approximately two and one year, respectively. B1 reported currently playing golf once per week and estimated having played a total of 45 hr during the previous year. B2 reported currently playing less than once a month, and estimated having played 60 hr of golf during the previous year. B3 reported not playing golf on a regular basis. Beginners reported not having a handicap.

Task

Participants were asked to perform a total of twenty 12-foot putts on the practice green of a golf course while thinking aloud. Participants were asked to verbalize their thoughts as they went through the several stages of putting, that is, from the analysis of the green until the observation of the outcome. Participants wore an external microphone that was attached to their shirts and plugged into a tape recorder to record verbalizations. Twenty golf balls were placed in groups of five, in four different positions around the cup. Participants were required to putt five times from one location and then proceed to the next location for another set of five putts. The four putt locations included two uphill and two downhill putts with breaks to the right and to the left.

Procedure

Participants were recruited by means of verbal advertisement of the study in a variety of classes where the purpose of the study and general procedures were explained. They were told that the purpose of the study was to identify what golfers of different caliber think about when they are putting, and what types of things they pay attention to when playing. The researcher agreed on a suitable time with each participant to run the experiment on the university practice green. Upon arrival, participants signed an informed consent and provided demographic information, such as age, gender, years of experience in playing golf, and frequency of play. Next, participants were allowed a warm-up period. Warm-up was divided into two periods. The first period consisted of putting practice on the green. During this period, participants practiced a variety of putts on a different cup than the one used for the experiment. The second period consisted of verbalization practice while putting. Participants were wearing the tape recorder and the microphone and were prompted to keep talking. The researcher provided feedback concerning appropriate ways of verbalizing to avoid generalization, inferences, and description of actions (see Ericsson & Kirk, 2001; Ericsson & Simon, 1993 for details). The warm-up task was terminated when participants reported feeling comfortable with verbalizing.

The instructions given to participants were the following:

> Please think aloud and verbalize everything that is going on in your mind as you perform this round of putts. Pretend that you are alone. Do not describe or explain what you are doing. Simply give voice to your thoughts by talking aloud as they appear in your mind.

Participants were further informed that throughout the task, the experimenter could prompt them to "keep talking." Prompting to "keep talking" may eventually increase reactivity because participants may feel forced to conform to the experimenter's expectations and report thoughts that otherwise would not represent usual thought processes. Therefore, participants were informed that this prompt should be understood only as a reminder to verbalize their thoughts and not as an obligation to report thoughts they were not having. It has been suggested that such an explanation reduces reactivity to verbalization (Ericsson & Kirk, 2001).

Data Analysis

Coding Verbal Responses and Protocol Analysis. Verbal reports were quantitatively analyzed according to a coding scheme developed for the current study. Each participant's verbal reports were transcribed verbatim and units of information (UI) were classified according to the following categories: (a) gathering information (GI) reflected participants' search for relevant characteristics of the environment (e.g., "there's a break left," "it is mostly uphill"); (b) planning (PL) referred to the definition of actions or strategies to reach a goal (e.g., "aim two cups right," "hit firm at the hole"); (c) technical instruction (TI) specified technical aspects of the motor performance (e.g., "arms bent," "feet are parallel"); (d) description of outcome (DO) reflected what had happened in terms of process or evaluation of the action (e.g., "[the ball] flew that by," "it broke at the end," "good putt"); (e) diagnosis (DGN) represented reasons for the observed outcome (e.g., "I didn't hit hard enough," "too firm"); (f) mental readiness (MR) refers to improving psychological preparation for the task (e.g., "you know you can do this," "concentrate on this"); (g) reactive comments (RC) consisted of verbalizations depicting reactive comments to performance (e.g., "This hole is not working for me!," "Oh, God . . . it should have gone in!"); and (h) other comments (OT) consisted of verbalizations that do not fit in any of the above categories, such as interjections (e.g., "alright," "ok") or irrelevant thoughts (e.g., "ah, ducks," "moving my ball").

Two judges coded verbal protocols of 15 putts from three different participants. Reliability was estimated by the equation, $n_a/(n_a+n_d) \times 100$, where n_a is the number of agreements and n_b is the number of disagreements. The same coders also coded the 15 verbal protocols 7 days later to determine the range of intrarater reliability. Overall interrater reliability estimates for the first and second moments were 0.63 and 0.78, respectively. Overall intrarater reliability was 0.73 to 0.85 for each judge. Even though there is considerable variability concerning cutoff coefficient values, Neuendorf (2002) stated that coefficients of 0.80 would be acceptable in most situations. In addition, Frey, Botan, and Kreps (2000) proposed a 70% agreement to be considered reliable.

To analyze thought sequences of experienced and beginning golfers, coded units of information in each putt were organized in a sequential manner. Absolute and relative frequencies for each pair of adjacent categories were calculated and used for comparing individuals and groups (i.e., skill level).

Discussion Analysis Tool System (DAT). Analysis of thought sequences was performed utilizing the Discussion Analysis Tool (DAT) system (Jeong, 2003). DAT is used to perform a sequential analysis in which the probabilities of a given event (e.g., thought) being elicited by a preceding event (e.g., thought) are calculated (Jeong, 2004). DAT performs an event sequence analysis by tallying the frequency of each thought interaction. The frequency of each target-thought is transformed into relative frequencies, or *transitional probabilities*. Transitional probabilities are estimates of the likelihood of a given thought (i.e., event) occurring or being elicited after a particular type of thought relative to all other types of thoughts also elicited after the first thought. In addition, DAT allows researchers to convert the observed transitional probabilities between thoughts into a *transitional state diagram*. This diagram is a graphic representation that supports the identification and analysis of patterns of event sequences. Each thought category is represented by a node, which is linked to another node by directional arrows. These arrows represent the relative frequency of each thought interaction, and the arrow thickness signifies the strength of the transitional probabilities between thought categories (Jeong, 2004). DAT has been used in sport to study patterns of communication in doubles tennis (Lausic, Tenenbaum, Eccles, Jeong, & Johnson, 2009) and appraisals and coping patterns in trapshooting competitive events (Calmeiro, Tenenbaum, & Eccles, 2010).

Results

Content of Verbalizations

To study the content of verbalizations, participants' verbal reports were transcribed and units of information were categorized. Figure 1 shows that experienced players verbalized more thoughts related to gathering information, planning, knowledge of results, and diagnosing than beginners. Beginning golfers verbalized more thoughts regarding technical instruction and mental preparation. Mann-Whitney tests revealed a significant difference between experienced players and beginners in gathering information ($Z = -1.96$, $p = 0.05$), planning ($Z = -1.96$, $p = 0.05$), diagnosing ($Z = -1.77$, $p = 0.046$), and description of outcome ($Z = -1.96$, $p = 0.05$). Nonsignificant differences were noted for technical instruction ($Z = -.66$, $p = 0.51$), mental readiness ($Z = -.66$, $p = 0.51$), reactive comments ($Z = -1.09$, $p = 0.28$), and others ($Z = -.22$, $p = 0.83$).

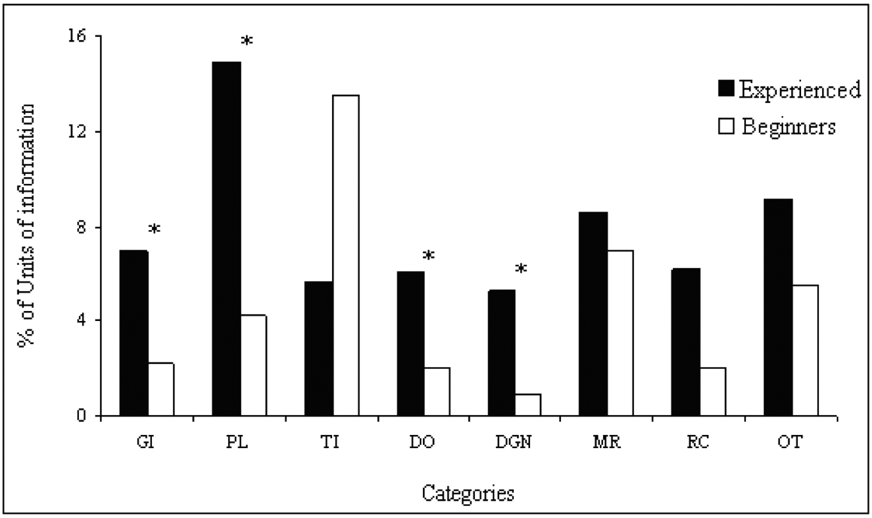

Figure 1 — Relative frequency of verbalizations (units of information) across categories for experienced and beginning players. GI = gathering information; PL = planning; TI = technical instruction; DO = description of outcome; DGN = diagnosis; MR = mental readiness; RC = reactive comments; OT = other.

Sequence of Thoughts

To analyze the sequence of thoughts, units of information for each putt were categorized and organized in sequential order. This is illustrated below for the first five putts (P1 through P5) of participant A1:

P1: GI; GI; PL; MR; PL; MR (Putt) DO.

P2: TI; GI; DO; PL; PL; PL; MR (Putt) DO; GI.

P3: OT; PL; TI; MR; D; O; PL; TI; PL; PL; PL (Putt) D; DO; OT; D.

P4: OT; MR; TI; MR; PL; MR; GI; PL; PL (Putt) DO.

P5: PL; MR; PL; MR (Putt).

Adjacent units of information were grouped in pairs, and frequencies for each pair sequence were calculated. Figure 2 shows paired-thoughts expressed in relative frequencies of units of information for experienced and beginning golfers. Only the most frequent pairs of sequential thoughts are shown. Experienced players expressed more thought sequences than did beginning players pertaining to gathering information (GI-GI; 4.3% vs. 0.5%, respectively; $Z = -2.00$, $p < .05$), planning (PL-PL; 14.3% vs. 1.3%, respectively; $Z = -1.53$, $p = 0.13$), and gathering information preceding planning (GI-PL; 6.0% vs. 1.5% respectively; $Z = -2.00$, $p < .05$). Sequences of planning-related thoughts followed by mental readiness were more frequent among experienced players than among beginners (PL-MR; 4.3% vs. 2.2%, respectively; $Z = -1.10$, $p = 0.28$), and the same was true for technical instruction (PL-TI; 8.0% vs. 3.4%, respectively; $Z = -1.10$,

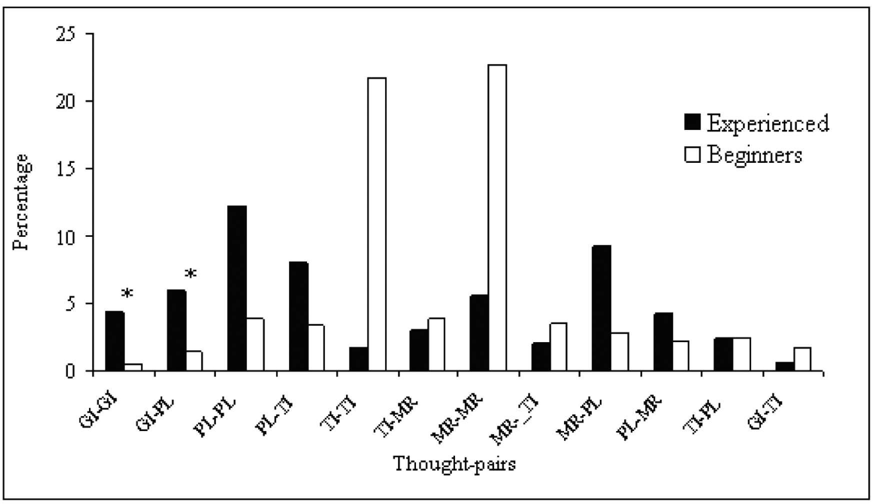

Figure 2 — Relative frequency of sequential pairs of thoughts before putting for experienced and beginning players. GI = gathering information; PL = planning; TI = technical instruction; DO = description of outcome; DGN = diagnosis; MR = mental readiness; RC = reactive comments; OT = other.

$p = 0.28$). Beginners reported more technical instruction sequences (TI-TI; 1.7% vs. 21.7%, respectively; $Z = -0.87$, $p = 0.38$) and mental readiness sequences (MR-MR; 5.6% vs. 22.7%, respectively; $Z = --0.66$, $p = 0.51$) than did experienced players.

Figures 3a and 3b represent, respectively, experienced players' and beginners' transitional state diagrams for analyzing patterns in thought sequences during putting. These diagrams were obtained through Jeong's (2003) DAT, and they support the process of analysis and identification patterns of thought processes. Nodes represent the study's categories, and the arrows linking these nodes represent the direction and strength of the interaction. Numbers in the transitional state diagrams represent the probability of one category being followed by another category. For example, in experienced golfers, the probability of diagnosing-related thoughts being followed by planning-related thoughts is 0.55 (i.e., DGN→PL, 0.55); in other words, 55% of diagnosing-related thoughts were followed by planning-related thoughts.

Thought patterns of experienced players suggest that they engaged in assessment (i.e., gathering information) and planning in the first stages of putting; 40% of the thoughts after initiating the putting task were categorized as gathering information (15%) and planning (25%). At the beginning of the putt, they also used information of previous results in the form of diagnosis (15%) to proceed to gathering of information (11%) or planning (37%). Again, once engaged in gathering information-related thoughts, they spent more time in this process (31%), and were more likely to follow it with planning-related thoughts (38%). Once they devised a plan, they were more likely to engage in mental readiness (19%) and technical instruction (18%). However, the stroke was most often preceded by mental readiness (36%). Therefore, after gathering information or planning, experienced players were more likely to follow with technical instruction, mental readiness, and putt (i.e., TI→MR→Putt), or mental readiness and putt (i.e., MR→Putt). After diagnosis, 21% of the thoughts were mental readiness-related (DGN-MR), which may justify the link between mental readiness and planning (20%); after diagnosing, experienced players engage in mental readiness to refocus and redefine plans.

Patterns of thought sequences of beginners were centered on technical instruction; furthermore, diagnosis was rarely used. These players started the task with mental readiness (29%), technical instruction (29%), or gathering information-related thoughts (26%). Planning was mainly preceded by gathering information (37%), however, and was more likely to be followed by putting (31%) or technical instruction (34%). Contrary to experienced players, 60% of technical instruction-related thoughts of beginners were followed by thoughts of the same category. Unlike experienced players, beginners did not usually return to thought processes associated with planning. Once they dealt with technical aspects of the task, they were more likely to putt (15%). Finally, diagnosing-related thoughts preceded putting (50%) and mental readiness (50%); note that percentages were based on only two diagnosing-related thoughts.

The number of verbalizations representing thought sequences after putting was low. Overall, only experienced players showed a pattern of thoughts characterized by acknowledging results followed by a diagnose-related thought (DO-D; four paired thoughts representing 13.8% of all paired thoughts).

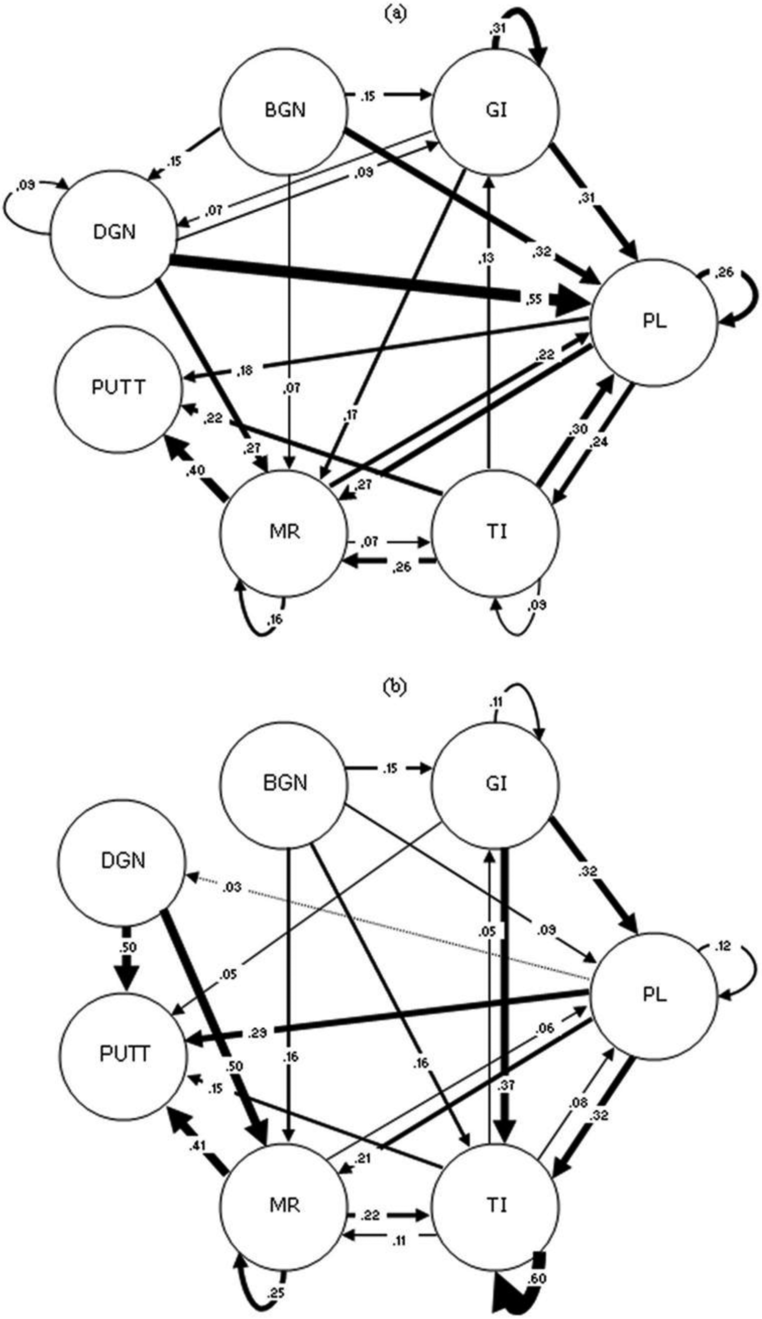

Figure 3 — Transitional state diagrams of sequential thought processes of (a) experienced players, and (b) beginning players. BGN = beginning of task; GI = gathering information; PL = planning; TI = technical instruction; DGN = diagnosis; MR = mental readiness.

Discussion

The aim of this study was to uncover patterns of cognitive processing used by golfers during a golf putt. Thought sequences of experienced and beginning players were compared to identify characteristic forms of problem solving that may discriminate between golfers of varying caliber.

Thought sequences of experienced players represent a temporal pattern of thoughts characterized by evaluation of putting conditions, determination of plans and goals, and shot execution. Consistent with findings of increased preshot planning of experts (e.g., McCaffrey & Orlick, 1989; Thomas & Over, 1994), planning strategy and goals appears to guide the execution stage. Self-monitoring seems to ensure that mental state and execution are adequate to carry out the plan or achieve the goal. It seems that, for experienced golfers, there is a coupling between shot execution and strategy/goals. Accordingly, expert tennis players have been shown to access and associate more varied, sophisticated, and interrelated concepts than novices did and to process more information pertaining to current event profiles and action plan profiles for developing and planning response selections (McPherson, 2000; McPherson & Kernodle, 2003). In the current study, experienced golfers were more able to look for relevant information on the green and engage in more solutions to play the shot.

In addition, experienced players verbalized more diagnostic-related thoughts after the putt and followed these thoughts with planning the next putt. This pattern becomes more marked after the first putt of each set of five putts: after gathering information for the first putt, further information gathering and planning are dependent on assessment needs. Conversely, beginners rarely diagnosed difficulties with performance. These differences likely represent more domain-relevant knowledge of experienced players compared with beginners (Beilock, Wierenga, & Carr, 2003; McPherson & Kernodle, 2003). As argued by Singer (2000), what athletes think about before, during, and after an event may impact performance; therefore, an understanding of these thoughts patterns in experienced players may prove useful to coaches, athletes, and sport psychologists to develop strategies that facilitate optimal performance.

Beginning players more often verbalized the mechanical aspects of putt execution than experienced players. The fact that experienced golfers did not engage in considerable technical instruction might indicate a higher degree of automaticity of motor control. Novices are thought to rely on step-by-step skill execution (Anderson, 1982; Beilock et al., 2002), during which poorly learned skills are "controlled by declarative knowledge that is held in short-term memory and attended step-by-step" (Beilock et al., 2003, p. 300). On the other hand, experienced players are thought to rely more on automatic processes during execution of well-learned skills, which are "supported by procedural knowledge that operates without the need for explicit or attended monitoring" (Beilock et al., 2003, p. 300).

Beilock et al. (2002) provided evidence indicating expert golfers' generic descriptions of a putt consisted primarily of assessing and planning. They also made fewer references to putting mechanics in their episodic recollections than novices. Novices' episodic recollections of skill mechanics represent higher allocation of attentional resources to these aspects during putt execution. These authors suggested that experts' higher declarative knowledge is not used during real time performance, because execution is controlled by automated procedural knowledge that runs outside working memory. In addition, confirming Beilock et al.'s contentions, thought-sequence analysis in the current study indicates that allocation of attention by beginners and experienced players also follows a different pattern. Experienced players did not report as many technical aspects of the skill as novice players, likely because this information was not being accessed by working memory. It is likely that experienced golfers' cognitive resources were oriented toward external cues aimed at "reading the green."

The higher number of verbalizations concerning planning strategies and goals of experienced golfers compared with beginning golfers is also consistent with McPherson's (2000) finding that expert tennis players generated more planning concepts than novices did. In line with increased gathering information among experienced rather than novice golfers, professional tennis players accessed more extensive and well-developed condition concepts during competition than novices (McPherson & Kernodle, 2003). Novice tennis players primarily generated concepts regarding execution goals, showed limited diagnosis of current game contexts, attended to less pertinent or inappropriate environmental features or game events, and planned shots less frequently.

According to McPherson and Kernodle (2003), novice tennis players generated "do-concepts" to explain why an execution failed rather than to find possible solutions for motor skill enhancement. Similarly, in the current study, beginning golfers verbalized more technical information-related thoughts to monitor their motor skills execution to make sure they went through all the steps, rather than to correct any aspect of their performance.

The transitional state diagram of the experienced players shows a pattern of thought processes initially revolving around assessment tasks (i.e., gathering information and establishing a plan), followed by preparation of shot execution by being technically and mentally ready; however, this preparation seems to be monitored by recurring thoughts of the established plan. Conversely, beginners' representation of thought sequences shows that technical instructions were more likely to occur at the beginning of the task, and after almost any other category of verbalization. Moreover, sequences of technical instruction-related thoughts (i.e., GI-GI) were also more likely than any other thought sequence.

Experienced players demonstrated a pattern of thoughts characterized by acknowledging results followed by diagnosing-related thoughts. Experienced players described and evaluated the outcome, and diagnosed more often than beginners, suggesting that information concerning past performance outcomes is used more by experienced players to diagnose and update subsequent performance strategies (McPherson, 2000). Although beginners demonstrated the same pattern of thoughts immediately after putting, frequencies were very low. Often, the beginners did not verbalize at all, which may represent either underdeveloped knowledge structures, quicker disengagement from the task, or both. The present data may indicate that experienced golfers have more structured thought processes than beginners do, representing a better balance among phases of the shot routine but disparate conscious effort allocated to each of the phases. This information may be used by coaches, athletes, or sport psychologists to improve the structure of preshot routines so that attentional resources are efficiently allocated to relevant cues in each stage of the routine.

Limitations and Future Directions

One limitation of the current study is concerned with the characteristics of the sample, which demands caution in the interpretation of the results. First, the small sample size used in the current study could explain some of the nonsignificant differences in this study; future research with a larger sample size must address this possibility. Second, even though to the best of our knowledge there is no evidence indicating gender differences in verbalization ability, it is possible that the gender composition of both groups constitutes a confounding variable. Third, more variability on golfers' levels of ability is recommended to confirm differences in thought patterns.

Another limitation is the low reliability of the coding scheme, which requires a clearer definition of categories. It appears, however, that the coding scheme represents to some degree the attentional demands required by the task, but proved to discriminate experienced and beginning players. Nevertheless, it appears that the tendencies observed are coherent and consistent with existing literature. Therefore, recommendations to the replication of this study include recruitment of a larger sample and including experts and intermediate level golfers, a more homogenous sample regarding gender, and a redefinition of the coding scheme. Finally, it is recommended to determine whether verbalizing during putting interferes with task outcome to ascertain utilization of concurrent verbal protocols in more ecologically valid situations.

Conclusion

The purpose of the current study was to (a) use a concurrent verbal protocol approach to uncover patterns of cognitive processes and (b) compare the content and sequence of thought processes of players of varying skill levels by utilizing an event-sequence analysis. The results indicate that experienced players spent more time than beginners did assessing the conditions and/or planning the putt. Experienced players had more thought sequences pertaining to gathering information, planned strategies and goals more often, and engaged in putt execution while referring back to the established goals and strategies without focusing on mechanical aspects of the task.

These results are consistent with findings that experts display better goals, planning, strategy use, self-monitoring, and self-evaluation than nonexperts and novices (Beilock & Carr, 2001; Beilock et al., 2002; Kitsantas & Zimmerman, 2002; McPherson & Kernodle, 2003; Thomas & Over, 1994). This information may be useful to coaches, athletes, and sport psychologists as it taps into thought sequences that can be used to identify golfers' self-talk patterns and construct more efficient preshot routines associated with allocation of attentional resources and problem solving.

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